इंटरनेट मानक

Disclosure to Promote the Right To Information

Whereas the Parliament of India has set out to provide a practical regime of right to information for citizens to secure access to information under the control of public authorities, in order to promote transparency and accountability in the working of every public authority, and whereas the attached publication of the Bureau of Indian Standards is of particular interest to the public, particularly disadvantaged communities and those engaged in the pursuit of education and knowledge, the attached public safety standard is made available to promote the timely dissemination of this information in an accurate manner to the public.

"जानने का अधिकार, जीने का अधिकार"
Mazdoor Kisan Shakti Sangathan
"The Right to Information, The Right to Live"

"पुराने को छोड नये के तरफ"
Jawaharlal Nehru
"Step Out From the Old to the New"

IS 13934 (1994): Test charts for surface grinding machines with two columns for grinding slideways [PGD 3: Machine Tools]

"ज्ञान से एक नये भारत का निर्माण"
Satyanarayan Gangaram Pitroda
"Invent a New India Using Knowledge"

Act Number 22 of 2005
The Indian Parliament
RIGHT TO INFORMATION

Made Available By
Public.Resource.Org

"ज्ञान एक ऐसा खजाना है जो कभी चुराया नहीं जा सकता है"
Bhartṛhari—Nītiśatakam
"Knowledge is such a treasure which cannot be stolen"

BLANK PAGE

BRUTUM FULMEN

IGNORANTIA JURIS NON EXCUSAT

PROTECTED BY COPYRIGHT

IS 13934 : 1994
ISO 4703 : 1984
(Reaffirmed 2004)

भारतीय मानक

पार्श्व अपघर्षण के लिए दो स्तम्भ वाली अपघर्षण मशीन के परीक्षण चार्ट

Indian Standard

TEST CHARTS FOR SURFACE GRINDING MACHINES WITH TWO COLUMNS FOR GRINDING SLIDEWAYS

UDC 621·924·2 : 620 (084·3)

© BIS 1994

BUREAU OF INDIAN STANDARDS
MANAK BHAVAN, 9 BAHADUR SHAH ZAFAR MARG
NEW DELHI 110002

August 1994

Price Group 7

Machine Tool Basics and Modular Units Sectional Committee, PE 03

NATIONAL FOREWORD

This Indian Standard which is identical with ISO 4703 - 1984 'Acceptance conditions for surface grinding the machines with two columns — Machines for grinding slideways — Testing of accuracy' issued by International Organization for Standardization (ISO), was adopted by the Bureau of Indian Standards on the recommendations of the Machine Tool Basics and Modular Units Sectional Committee and approval of the Production Engineering Division Council.

Certain conventions are, however, not identical to those used in Indian Standards. Attention is particularly drawn to the following:

a) Inch values as given in the above ISO have not been retained in this standard as these are not prevalent in the country.

b) This Indian Standard uses a point (.) as a decimal marker in place of comma (,) used in the International Standard.

c) Wherever the words 'International Standard' appear referring to this standard, they should be read as 'Indian Standard'.

In this adopted standard, reference appears to ISO/R 230 (since revised as ISO 230/1 - 1986) Test code for machine tools. The Indian Standard IS 2063 : 1988 'Acceptance code for machine tools : Geometric accuracy of machines operating under no-load or finishing conditions (*first revision*)' which is identical with ISO 230/1 - 1986 is to be substituted in its place.

Indian Standard

TEST CHARTS FOR SURFACE GRINDING MACHINES WITH TWO COLUMNS FOR GRINDING SLIDEWAYS

1 SCOPE AND FIELD OF APPLICATION

This International Standard specifies, with reference to ISO/R 230, geometrical and practical tests on general purpose and normal accuracy surface grinding machines with two columns — machines for grinding slideways — and gives the corresponding permissible deviations which apply.

It should be noted that the machines covered by this International Standard are machines with rectilinear grinding movements and with a movable table. Machines with a fixed table or with a rotary table movement are outside the scope.

It deals only with the verification of accuracy of the machine. It does not apply to testing the running of the machine (vibrations, abnormal noises, stick-slip motion of components, etc), or to its characteristics (speeds, feeds, etc) which should generally be checked before testing accuracy.

2 PRELIMINARY REMARKS

2.1 In this International Standard, all the dimensions and permissible deviations are expressed in millimetres and in inches.

2.2 To apply this International Standard, reference should be made to ISO/R 230, especially for the installation of the machine before testing, warming up of spindles and other moving parts, description of measuring methods and recommended accuracy of testing equipment.

2.3 The sequence in which the geometrical tests are given is related to the sub-assemblies of the machine, and this in no way defines the practical order of testing. In order to make the mounting of instruments or gauging easier, tests may be carried out in any order.

2.4 When inspecting a machine, it is not always necessary to carry out all the tests specified in this International Standard. It is up to the user to choose, in agreement with the manufacturer, those tests relating to the properties which are of interest to him, but these tests are to be clearly stated when ordering a machine.

2.5 Practical tests shall be made with finishing cuts and not with roughing cuts, which are liable to generate appreciable cutting forces.

2.6 When establishing the tolerance for a measuring range different from that given in this International Standard (*see* clause **2.311** of ISO/R **230**), it should be taken into consideration that the minimum value of tolerance is 0·001 mm.

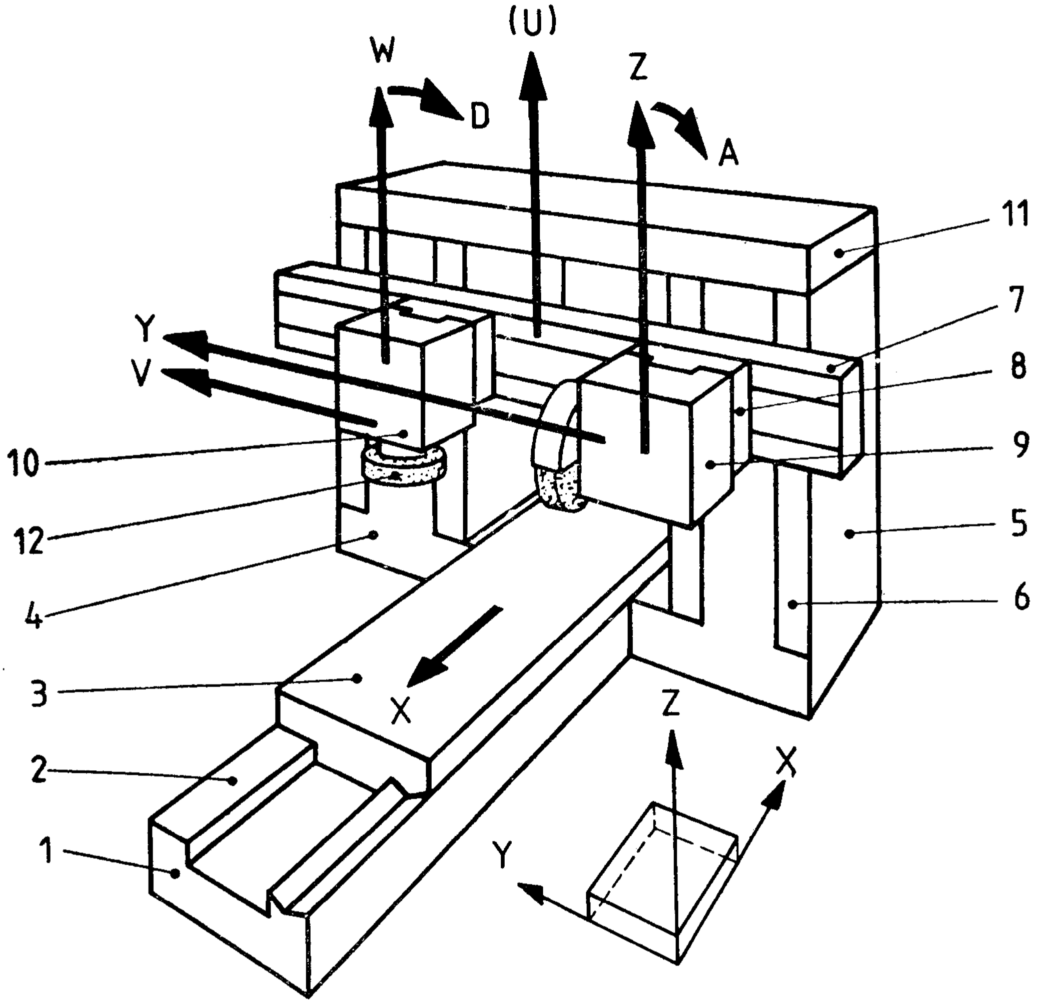
3 REFERENCE

ISO/R 230, *Machine tool test code*.

4 DIAGRAMS

For reasons of simiplicity the drawings in this International Standard illustrate only one type of machine.

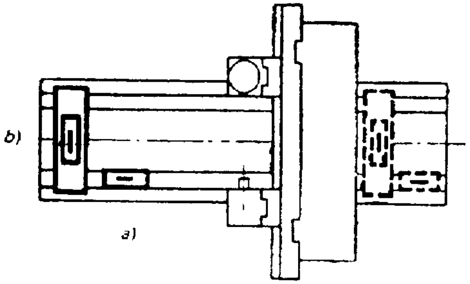
5 TERMINOLOGY

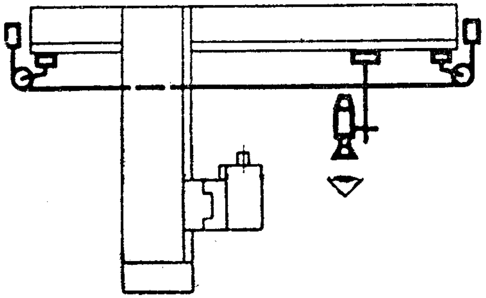


No.	Designation
1	Bed
2	Slideway
3	Table
4	Left-hand column
5	Right-hand column
6	Slideway, right-hand column
7	Cross rail
8	Saddle
9	Right-head wheelhead (horizontal spindle)
10	Left-hand wheelhead (vertical spindle)
11	Bridge
12	Grinding wheel

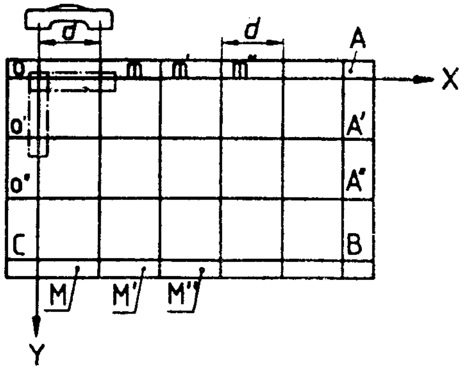
6 ACCEPTANCE CONDITIONS AND PERMISSIBLE DEVIATIONS

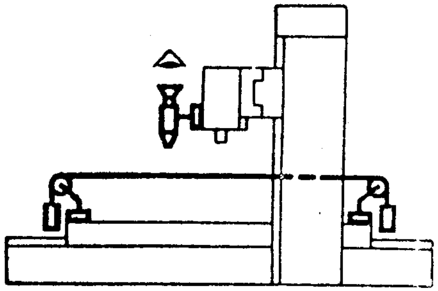
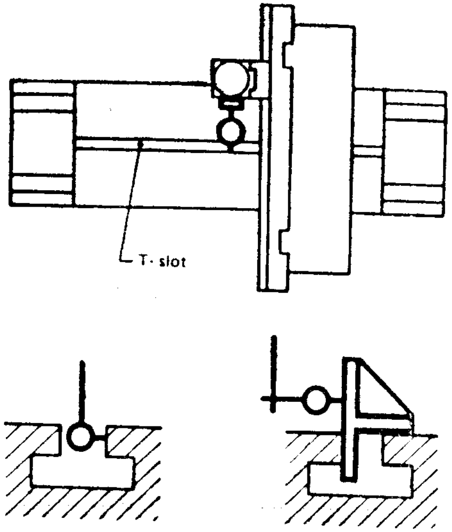
6.1 Preliminary operations

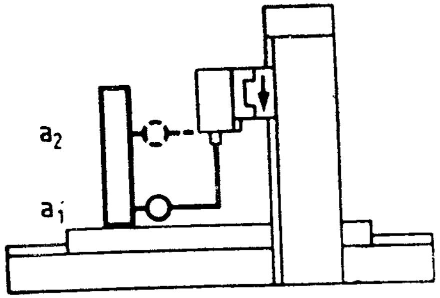
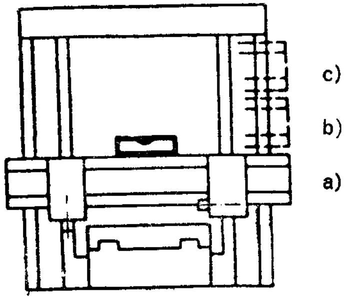
No.	Diagram	Object	Permissible deviation mm	Measuring instruments	Observations and references to test code ISO/R 230
G01		Verification of levelling and of the bed slideways[1] *a)* Longitudinal verification: Testing of straightness of the slideways in a vertical plane; *b)* Transverse verification.	*a)* 0·01 for any measuring length of 1 000 *b)* 0·02/1 000	Precision levels or optical methods	Clauses 3.11, 3.21, 5,212.21, 5.212.22 and 5.412.7 Table dismantled. *a)* Mesurements shall be made at positions equally distributed along the length of the bed. *b)* A level shall be placed transversely on the slideways and measurements taken at a number of positions spaced along the length of the slideways. The variation of level measured at any positions shall not exceed the permissible deviation. These tests shall be carried out when assembling the machine. 1) The characteristics of the basic form of the bed from which the permissible deviation is measured shall be specified by the manufacturer.

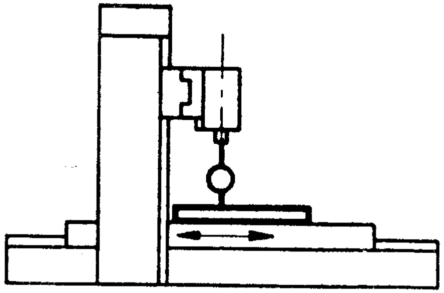
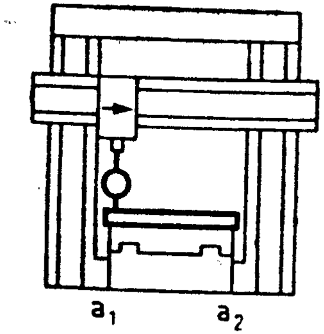
No.	Diagram	Object	Permissible deviation mm	Measuring instruments	Observations and references to test code ISO/R 230
G02		*a*) Verification of straightness of the bed slideways in a horizontal plane; *b*) In the case of two V slideway machines, verification of parallelism.	*a*) 0·01 for any measuring length of 1 000 *b*) 0·02	Microscope and taut wire or other optical measuring methods, special support	Clauses 5.212.3 and 5.232.2 Table dismantled Wire shall be set at the ends of the slide-way, made taut and positioned. The special support and the microscope shall be positioned on the slideways. Measurements shall be made at positions equally distributed over the length of the bed. This test shall only be carried out when instructions on levelling have not been provided by the manufacturer.

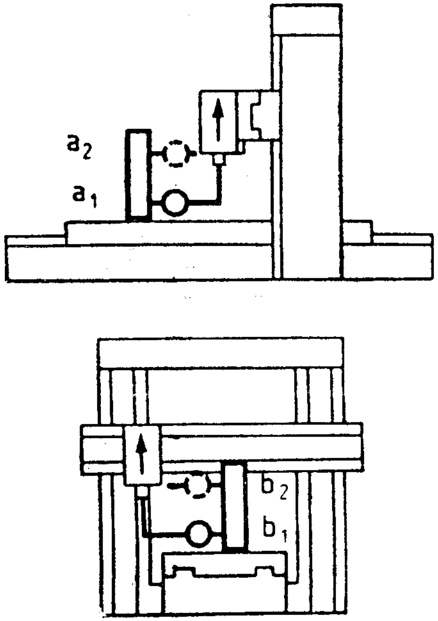
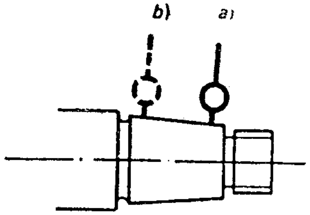
6.2 Geometrical verifications

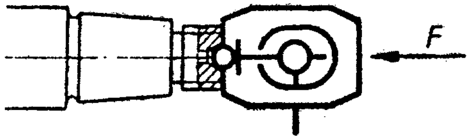
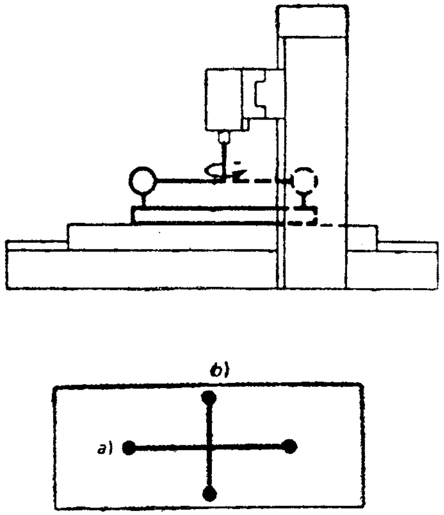
G1	 d d A X O m m' m" O' A' O" A" C B M M' M" Y	Verification of flatness of the table surface within the grinding area.	— up to 1 000 0·01 — over 1 000 up to 2 000 0 02 — over 2 000 up to 5 000 0·03 — over 5 000 up to 10 000 0·04 — over 10 000 0·05 local tolerance: 0·005 for any measuring length of 500	Straightedge and gauge blocks or precision levels or other methods	Clauses 5.322, 5.323 and 5.324 Table not locked in mid-travel.

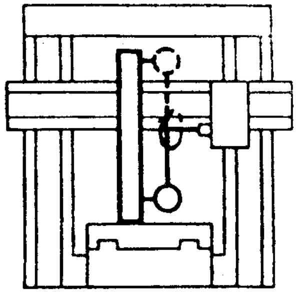
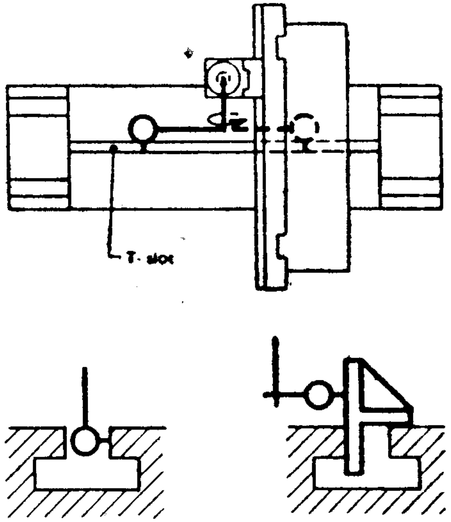
No.	Diagram	Object	Permissible deviation mm	Measuring instruments	Observations and references to test code ISO/R 230
G2		Verification of straightness of the table longitudinal movement in a horizontal plane.	— up to 1 000 0·01 — over 1 000 up to 2 000 0·02 — over 2 000 up to 5 000 0·03 — over 5 000 up to 10 000 0·04 — over 10 000 0·05	Microscope and taut wire or other optical methods	Clauses 5.212.2 and 5.212.3 Wire shall be set at the ends of the table, made taut and positioned. The microscope shall be positioned on the wheel head. Note the variation in the maximum deviation.
G3		Verification of parallelism of the median or reference T-slot to the longitudinal movement of the table.	— up to 5 000 0·02 — over 5 000 0·03 Local tolerance : 0·01 for any measuring length of : 1 000	Dial gauge support, dial gauge and square	Clauses 5.422.1 and 5.422.21 If the spindle can be locked, the dial gauge may be mounted on it; if the spindle cannot be locked, the dial gauge shall be placed on a fixed part of the machine.

No.	Diagram	Object	Permissible deviation mm	Measuring instruments	Obervations and references to test code ISO/R 230
G4		Verification of squareness of the cross rail movement (vertical slide) with the table surface in a longitudinal plane. (This shall only be carried out in the case of machines performing surface grinding transverse to the direction of table movement when the vertical movement of the wheel head is not sufficient.)	0·02/500	Dial gauge support, dial gauge and cylindrical square	Clause 5.512.2 Table in mid-travel. The dial gauge support and the dial gauge shall be connected to a fixed part of the cross rail (vertical slides). The stylus shall be placed in the longitudinal direction at point a_1 on the cylindrical square. The cross rail shall be moved from point a_1 to point a_2. The variation in the maximum deviation shall be noted.
G5		Verification of the variation of the level of the cross rail in its vertical movement: *a*) in the lower position; *b*) in the central position; *c*) in the upper position.	0·01/1 000	Precision levels	Clause 5.212.2 Each time, raise to the positions *a*), *b*) and *c*) from the bottom towards the top and read the deviation. Loads imposed by the wheelheads shall be distributed symmetrically. Cross rail locked in each position.

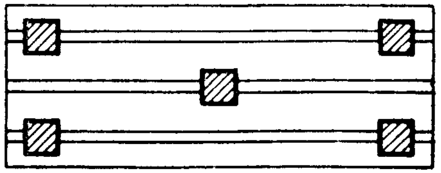
No.	Diagram	Object	Permissible deviation mm	Measuring instruments	Observations and references to test code ISO/R 230
G6		Verification of parallelism of the table surface to its longitudinal movement.	— up to 1 000 0·01 — over 1 000 up to 2 000 0·015 — over 2 000 up to 5 000 0·02 — over 5 000 up to 10 000 0·03 — over 10 000 0·035	Dial gauge support, dial gauge, straightedge and gauge blocks	Clauses 5.412.2 and 5.422.21 The dial gauge support and the dial gauge shall be fixed on the wheelhead. The stylus shall be set on the straightedge or the gauge blocks placed on the table, and the deviation noted. The measurement shall be carried out in the middle of the table and very close to the two outside edges.
G7		Verification of parellelism of the table surface to the transverse movement of the wheelhead.	— up to 1 000 0·01 For each 1 000 mm increase beyond 1 000 mm add to the tolerance : 0·01 Local tolerance : 0·01 for any measuring length of : 1 000	Dial gauge support and dial gauge, straightedge and gauge blocks	Clause 5.422.22 Table in mid-travel. The dial gauge support and the dial gauge shall be fixed on the wheelhead. The stylus of the dial gauge shall be set at point a_1 on the straightedge (gauge blocks). The wheelhead shall be moved along the measuring length to point a_2 and the variation in the maximum deviation noted. The measurement shall be carried out in the lowest possible position of the cross rail. In the case of a supplementary wheelhead, the verification shall be carried out in the same manner.

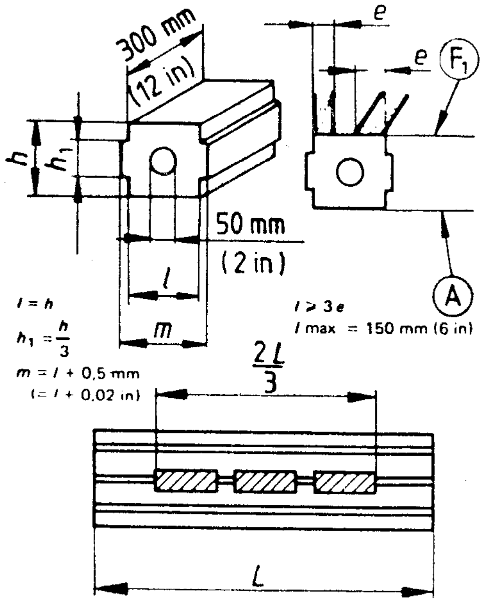
No.	Diagram	Object	Permissible deviation mm	Measuring instruments	Observations and references to test code ISO/R 230
G8		Verification of squareness of the vertical movement of the wheelhead with the table surface : *a*) in a longitudinal plane; *b*) in a transverse plane.	**A — HORIZONTAL SPINDLE** *a*) 0·006/100* *b*) 0·006/100 **B — VERTICAL SPINDLE** *a*) 0·004/100 *b*) 0·003/100	Dial gauge support, dial gauge and cylindrical square	Clause 5.512.2 Table in mid-travel. The dial gauge support and the dial gauge shall be fixed on the wheelhead. The stylus of the dial gauge shall be placed in a longitudinal plane at point a_1 on the cylindrical square. The wheelhead shall be moved to point a_2. Note the variation in the deviation. The cylindrical square shall be rotated through 180° and the verification repeated in the same order. The mean value shall be found. Then carry out the verification in a transverse plane at points b_1 and b_2. For each wheelhead, the verification shall be carried out in the same manner. *In the case of horizontal spindles, verification *a*) will only be carried out if requested.
G9		Measurement of run-out of the taper of the grinding spindle.	**A — HORIZONTAL SPINDLE** 0·005 **B — VERTICAL SPINDLE** 0·005	Dial gauge support and dial gauge	Clauses 5.612.1 and 5.612.2 The stylus shall be placed perpendicular to the generatix of the taper. In addition to the specifications of test code ISO/R 230, measurement shall be carried out at each end of the taper. The verification shall be carried out on each spindle of the machine.

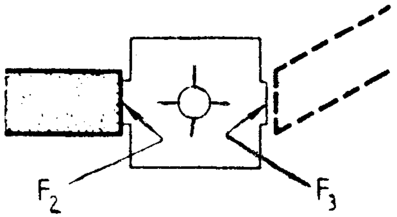
No.	Diagram	Object	Permissible deviation mm	Measuring instruments	Observations and references to test code ISO/R 230
G10		Measurement of the periodic axial slip of the grinding spindle.	0·005	Dial gauge support, dial gauge, steel ball	Clauses 5.622.1 and 5.622.2 A force *F*, specified by the manufacturer of the machine, shall be exerted coaxial with the spindle. The stylus of the dial gauge shall be set coaxial with the spindle axis. The verification shall be carried out on each spindle of the machine.
G11		Verification of squareness of the axis of the grinding spindle with the surface of the table : *a*) in a longitudinal plane; *b*) in a transverse plane. (Only for machines with non-swivelling wheelhead).	*a*) 0·01/300* *b*) 0·01/300*	Arm support, dial gauge, straightedge and gauge blocks	Clauses 5.512.1 and 5.512.42 Table in mid-travel. Wheelhead clamped, if possible. *Distance between the two points touched.

No.	Diagram	Object	Permissible deviation mm	Measuring instruments	Observations and references to test code ISO/R 230
G12		Only for machine with a horizontal grinding spindle, with the wheelhead attached to the cross rail or with the wheelhead attached to the column. Verification of parallelism of the axis of the grinding spindle to the table surface. (Only for machines with non-swivelling wheelhead.)	0·01/300*	Arm support, dial gauge, cylindrical square	Clauses 5.512.1 and 5.512.42 Table in mid-travel. Wheelhead clamped, if possible. * Distance between the two points touched.
G13		Verification of squareness of the grinding spindle axis to the median or reference T-slot of the table.	0·015/300*	Arm support dial gauge, straightedge or other auxiliary means	Clauses 5.422.1 and 5.422.21 Table in mid-travel. The dial gauge shall be mounted on the spindle with the stylus of the dial gauge touching the median or reference T-slot. The spindle shall then be rotated to bring the stylus once again in contact with the above T-slot. The deviation shall then be noted. *Distance between the two points touched.

6.3 Practical tests

No.	Diagram and dimensions to the test pieces	Nature of test and grinding conditions	Checks to be applied	Permissible deviation mm	Measuring instruments	Observation and references to test code ISO/R 230
P1	 Machining of : — 5 test pieces for table of length up to 5 000 mm. — 7 or 8 test pieces for table of length over 5 000 mm. Material from which the test pieces are manufactured may be either: a) cast iron; or b) steel. The test pieces shall all have the same hardness and shall be suitably fixed on the table. The dimensions of the surface to be machined shall be as small as possible; for example, square with sides 50 mm × 50 mm (cylinder with diameter 50 mm).	Machining of 5, 7 or 8 test pieces. The surface of the test pieces in contact with the table shall be ground before carrying out the test. The test pieces shall be positioned as follows : — in the case of 5 pieces : one at the central point of the table; one at each of the four corners of the table; — in the case of 7 or 8 pieces : by agreement.	Surface grinding. The thicknesses of the test pieces after grinding shall be identical.	Maximum permissible deviation for a distance between any two test pieces of : — up to 1 000 0·01 — over 1 000 up to 2 000 0·02 — over 2 000 up to 3 000 00·3 — over 3 000 0·04	Dial gauge support, precision dial gauge	NOTE — Practical tests P1 and P2 will only be carried out if there is no other particular specification (i.e. machining of a special work piece requested by the user). Clauses 3.1, 3.22,4.1 and 4.2 Test piece ground taken off the machine and placed on a surface plate shall be successively measured with an appropriate measuring instrument. The point of measurement, is the centre of the machined surface of the test pieces.

No.	Diagram and dimensions of the test pieces	Nature of test and grinding conditions	Checks to be applied	Permissible deviation mm	Measuring instruments	Observation and references to test code ISO/R 230
P2	 300 mm (12 in) e e F_1 h h_1 50 mm (2 in) l m A $l = h$ $h_1 = \frac{h}{3}$ $m = l + 0{,}5$ mm $(= l + 0.02$ in) $l \geqslant 3e$ l max = 150 mm (6 in) $\frac{2L}{3}$ L L = length to be ground. $\frac{2L}{3}$ = length of the test pieces, mounted in succession.	Grinding of slideways. Grinding of surface F_1. Mechnical fixing of the test pieces on the table. Mounting and fixing of the test pieces shall be made on the table in succession and so that the pieces are not subject to deformation. For a first test, the pieces will be mounted on the centre of the table. The pieces can then be mounted on the longitudinal sides to the table. The surface A, laid on the table, which is used as a reference surface for the measurements, shall be carefully machined before mounting.	Variation in height in the longitudinal direction.	Fixing length on the table $\left(\frac{2L}{3}\right)$: — up to 2 000 0·010 — over 2 000 up to 5 000 0·015 — over 5 000 up to 8 000 0·020 — over 8 000 up to 10 000 0·025	Dial gauge support, precision dial gauge, surface plate.	NOTE — Practical tests P1 and P2 will only be carried out if there is no other particular specification (i.e. machining of a special work piece requested by the user). Clauses 3.1, 3.22, 4.1 and 4.2 Test pieces ground, taken off the machine and placed on a surface plate shall be successively measured with an appropriate measuring instrument. The point of measurement is the centre of the machined surface of the test pieces.

No.	Diagram and dimensions of the test pieces	Nature of test and grinding conditions	Checks to be applied	Permissible deviation mm	Measuring instruments	Observations and references to test code ISO/R 230
P3		Grinding of sideways. Machining of the lateral surfaces F_2 and F_3. Parallelism of the grinding surfaces F_2 and F_3. Pieces to be situated in the middle of the table. The number and disposition of the test pieces to be ground are the same as for test P_2.	Variation in width.	Fixing length on the table $\left(\frac{2L}{3}\right)$: — up to 2 000 0·010 — over 2 000 up to 5 000 0·015 — over 5 000 up to 8 000 0·020 — over 8 000 up to 10 000 0·025	Dial gauge support, precision dial gauge, surface plate	NOTE — Practical test P3 will only be carried out if there is no other particular specification (i.e, machining of a special work piece requested by the user). Clauses 3.1, 3.22, 4.1, 4.2 and 5.412.2 Test pieces ground on the surface plate shall be successively measured with an appropriate measuring instrument. The point of measurement is the centre of the machining surface of the test pieces.

Bureau of Indian Standards

BIS is a statutory institution established under the *Bureau of Indian Standards Act, 1986* to promote harmonious development of the activities of standardization, marking and quality certification of goods and attending to connected matters in the country.

Copyright

BIS has the copyright of all its publications. No part of these publications may be reproduced in any form without the prior permission in writing of BIS. This does not preclude the free use, in the course of implementing the standard, of necessary details, such as symbols and sizes, type or grade designations. Enquiries relating to copyright be addressed to the Director (Publications), BIS.

Review of Indian Standards

Amendments are issued to standards as the need arises on the basis of comments. Standards are also reviewed periodically; a standard along with amendments is reaffirmed when such review indicates that no changes are needed; if the review indicates that changes are needed, it is taken up for revision. Users of Indian Standards should ascertain that they are in possession of the latest amendments or edition.

This Indian Standard has been developed from Doc No. PE 03 (0045).

Amendments Issued Since Publication

Amend No.	Date of Issue	Text Affected

BUREAU OF INDIAN STANDARDS

Headquarters:

Manak Bhavan, 9 Bahadur Shah Zafar Marg, New Delhi 110002
Telephones : 331 01 31, 331 13 75

Telegrams : Manaksanstha
(Common to all offices)

Regional Offices :

		Telephone
Central :	Manak Bhavan, 9 Bahadur Shah Zafar Marg NEW DELHI 110002	331 01 31 331 13 75
Eastern :	1/14 C. I. T. Scheme VII M, V. I. P. Road, Maniktola CALCUTTA 700054	37 84 99, 37 85 61 37 86 26, 37 86 62
Northern :	SCO 335-336, Sector 34-A, CHANDIGARH 160022	60 38 43 60 20 25
Southern :	C. I. T. Campus, IV Cross Road, MADRAS 600113	235 02 16, 235 04 42 235 15 19, 235 23 15
Western :	Manakalaya, E9 MIDC, Marol, Andheri (East) BOMBAY 400093	632 92 95, 632 78 58 632 78 91, 632 78 92

Branches : AHMADABAD. BANGALORE. BHOPAL. BHUBANESHWAR.
COIMBATORE. FARIDABAD. GHAZIABAD. GUWAHATI. HYDERABAD.
JAIPUR. KANPUR. LUCKNOW. PATNA. THIRUVANANTHAPURAM.

Printed at New India Printing Press, Khurja, India